

TAB 11

Closure Plan
(Checklist Item #11)

**Cherry Island Landfill
Sanitary Landfill Permit Renewal**

Section 4.2.1.7.6 of the Delaware Regulations Governing Solid Waste (DRGSW) requires that a Closure Plan be included when applying for a permit (or renewal) to construct and/or operate a sanitary or industrial waste landfill. Attached herein is the Closure Plan as prepared by GeoSyntec Consultants, dated September 2003, for the Northern Solid Waste Management Center (also known as Cherry Island Landfill) located in Wilmington, New Castle County, Delaware. An update to the proof of financial responsibility for closure and post-closure care is included in this application under Checklist Item #12.

Prepared for:

Delaware Solid Waste Authority

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Dover Delaware 19903

CLOSURE PLAN

**Northern Solid Waste Management Center
Wilmington, New Castle County, Delaware**

Contract No. S01445NC

Prepared by:



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1. INTRODUCTION

1.1 Terms of Reference

The purpose of this report is to address the requirements for landfill closure and post-closure care for the expansion of the Cherry Island Landfill (CIL) at the Northern Solid Waste Management Center (NSWMC) located in Wilmington, New Castle County, Delaware. The landfill is owned by the Delaware Solid Waste Authority (DSWA). In this report, the requirements of the Delaware Regulations Governing Solid Waste (DRGSW), Section 5.J (i.e., Closure), and 5.K (i.e., Post-Closure Care) are addressed.

This report was prepared by Ms. Carrie H. Pendleton, Mr. Paul J. Boteck, and Mr. Michael F. Houlihan, P.E., and was reviewed by Mr. Eric S. Steinhauer, P.E., all of GeoSyntec Consultants (GeoSyntec) in accordance with the internal peer review policy of the firm. This report was prepared to fulfill a requirement of Contract No. S01445NC (Contract) issued on 17 December 2001 by DSWA.

1.2 Regulatory Requirements and Closure Plan Organization

This Closure Plan has been prepared to meet the closure and post-closure care requirements for sanitary landfills, as defined in DRGSW Sections 5.J and 5.K and related sections. The required content of closure plans is presented in DRGSW § 5.J.3. The required Closure Plan contents and the location where the requirements are addressed in this plan are as follows:

- in the remainder of Section 1, definitions and an overview of closure and post-closure care activities for CIL are presented;
- the methods, procedures, and processes that will be used to close CIL (DRGSW § 5.J.3.a) are described in Section 2;
- pre-closure activities (DRGSW § 5.J.3.c) are described in Section 3;
- a description of the closure system components (DRGSW § 5.J.3.b) is presented in Section 4;
- closure and post-closure cost estimates (DRGSW § 5.J.3.d) are presented in Section 5;

- a post-closure care plan (DRGSW § 5.J.3.e and § 5.K) is presented in Section 6; and
- a landfill gas control plan (DRGSW § 5.J.3.f) is presented in Section 7.

1.3 Definitions

The following definitions are used throughout this Closure Plan. These definitions are consistent with the definitions presented in DRGSW § 3, but they have been clarified to better describe activities that will be performed for closure and post-closure care of the CIL.

- “*Closure*” is defined as cessation of waste disposal operations at CIL and completion of construction of a closure system over waste disposal areas. The activities to be performed during closure (as described in this section) are intended to minimize the need for further maintenance of the landfill and to prevent the escape of solid waste, leachate, or landfill gas constituents to the environment, as required by DRGSW § 5.J.1. Closure will include pre-closure and final closure activities, as defined below:
 - “*Pre-Closure*” is defined as closure activities that will be performed after cessation of waste disposal operations in a portion of the CIL but before the cessation of all waste disposal operations at CIL.
 - “*Final Closure*” is defined as final capping of the entire landfill disposal area, completion of the surface-water management system and site access roads, revegetation of all disturbed areas, construction of the post-closure landfill gas removal system, and development of post-closure use features (if any).
- “*Interim Landfill Cover*” is defined as a temporary cover system placed over the final grading layer after final waste grades are achieved in an area of the landfill. Long-term Interim Cover is not required but may be used at DSWA’s discretion to minimize infiltration of rainwater and the escape of landfill gas during the period between cessation of waste disposal operations and construction of the final capping system required under DRGSW § 5.H.
- “*Post-Closure Care*” is defined as the maintenance and monitoring activities that will be performed during the 30-year post-closure care period (as required

by DRGSW § 5.K). Post-closure care includes all activities that will be performed following closure, such as: operation of the leachate, landfill gas, and surface-water management systems; long-term maintenance; and environmental monitoring.

In this Closure Plan, the "Drawings" refer to the drawing package entitled, "*Permit Drawings for Landfill Expansion, Cherry Island Landfill*", Wilmington, Delaware, Contract No. SO1445NC, by GeoSyntec Consultants dated 13 June 2004. These drawings are included in Appendix VIb-A (i.e., Reduced Size Set of Permit Drawings) of the Engineering Report (i.e., Part VIb of the Permit Modification Application).

1.4 Overview of Closure and Post-Closure Care Activities

1.4.1 Introduction

CIL will be closed according to the closure requirements of the DRGSW. In this section, an overview is presented of the activities that will be performed for closure and post-closure care of CIL, and references are provided for the location in this report where the activities are described in more detail.

1.4.2 Required Submittals and Notifications

DSWA will make several submittals and notifications, as required by DRGSW § 5.J.2, to describe its intentions for closure and post-closure care to DNREC and the public. These submittals and notifications are identified below.

- As required under DRGSW § 5.J.2.a, this Closure Plan has been prepared and is being submitted as part of the initial application for permit to dispose waste at CIL. The engineering design and layout of the closure system is described in more detail in Part VIb, Section 4.5 of this Permit Modification Application document.
- Written notification of DSWA's intent to close CIL will be provided to DNREC at least 180 days before the date of final receipt of waste, as required in DRGSW § 5.J.2.b. As described in Part VIb, Section 4.5 of this Permit Modification Application, the anticipated date of final receipt of waste for CIL,

based on the configuration of CIL shown on Drawing 86, will be in 2025. Therefore, in early 2025, DSWA will set a preliminary date for notification of intent to close the landfill.

- DSWA will not commence closure of CIL until a closure permit has been issued for the facility, as required by DRGSW § 5.J.2.c. When DSWA issues its notification of intent to close CIL, a closure schedule and revised Closure Plan will also be submitted to DNREC, as required under DRGSW § 5.J.2.c. Once the closure permit has been issued (according to DRGSW § 5.J.2.d), the Closure Plan will be executed as described in the terms of the permit.
- A copy of this Closure Plan will be maintained at the CIL facility at all times during facility operation and throughout the post-closure care period, as required by DRGSW § 5.J.2.e.
- A notification in the deed to the CIL property will be made at the time of closure, as required under DRGSW § 5.K.5. The notification will indicate that the land has been used as a solid waste disposal site and that the use of the land is restricted under DRGSW.

1.4.3 Closure Construction Activities

To close CIL, DSWA will perform several activities that are intended to minimize the need for further maintenance of the landfill and minimize the potential for escape of solid waste, leachate, and landfill gas constituents. These closure activities will include construction of the following features: (i) the interim landfill cover, over portions of the landfill if needed; (ii) the capping system; (iii) the permanent landfill gas management system (if needed); and (iv) the surface-water management system. Construction activities associated with each of these features is briefly described in the following paragraphs.

Interim Landfill Cover. Because the CIL will be constructed in stages, some areas of the landfill will be filled to final grade before other areas. DSWA may construct an interim landfill cover over areas that have been filled to final grade before the date of cessation of all waste disposal operations. The purposes of constructing interim cover over these areas are: (i) to minimize the amount of infiltration into the landfill prior to construction of the final cover; and (ii) to control landfill gas prior to the construction of the permanent landfill gas management system. Interim cover will consist of a one-foot

(0.3-m) thick layer of soil that meets the DRGSW requirements for the final grading layer, as described in Section 3.4 of this report.

Capping System. DSWA will construct a capping system over all waste disposal areas after waste in an area has been filled to the final permitted grades. As described on Page 2, closure activities may be performed in stages involving closure of portions of the landfill that have been filled to final grades, but before the entire CIL is filled and closed. It is assumed that such "pre-closure" activities can be performed as a normal part of facility operations without obtaining a closure permit, as is currently done at DSWA's Central Solid Waste Management Center (CSWMC) and Southern Solid Waste Management Center (SSWMC). The capping system will consist of one or a combination of the two capping alternatives currently permitted [Weston, 1992]. These capping system alternatives and closure system components are described in Section 4 of the report, entitled "*Northern Solid Waste Management Center, Cherry Island Landfill, Phase IV Disposal Area, Hydrogeological Geotechnical and Landfill Capping Report*", prepared by Weston [1992] attached to this permit modification application in Volume 14. The cover system will be constructed in stages as the facility is developed; it is expected that, at the time of final disposal of waste in the landfill, there will be about 40 acres of landfill that has not been capped yet. Depending upon the cover system selected, construction of the final cover will be performed over a period of approximately two to four years after final closure of the CIL, during which time the permanent landfill gas management system and the surface-water management system will also be constructed. If future landfill cells are permitted adjacent to CIL that result in future overfilling in areas of the proposed expansion, then the final landfill cover will not be constructed in these areas until after the overfill areas are completely filled; such activities, if any, would be described in a future application for permit modification.

Permanent Landfill Gas Management System. Before construction of the final landfill cover, DSWA will construct enhancements to the permanent landfill gas management system, if needed. The design of the permanent landfill gas management system is described in Part VIb, Section 4.4 of the Permit Modification Application report and is illustrated on Drawings 71 through 77. As shown on the drawings, the gas system will consist of a series of horizontal and vertical gas extraction pipes that will be installed in phases throughout the operating life of the landfill. At the time of final closure or closure of a portion of the landfill, the adequacy of the gas management system will be confirmed and, if modifications are needed to provide adequate

collection of landfill gas in an area, then the modifications will be designed and constructed at that time.

Permanent Surface-Water Management System. During construction of the landfill capping system, the permanent surface-water management system will be constructed. The design of the system is presented in detail in Part V, Section 4.7 of the Permit Modification Application report. During construction and filling of CIL, the system will be used for both sediment control and storm-water management; after closure (i.e., after all surfaces have been seeded and stabilized), the system will be used only for storm-water management. The permanent surface-water management system described in the permit application report is designed to manage runoff from the entire CIL capping system. If future landfill cells are permitted adjacent to CIL that result in overfilling of portions of the proposed expansion area, then the system described in this permit application may need to be revised to address the adjacent cells.

1.4.4 Post-Closure Care, Maintenance, and Monitoring

After closure of CIL has been completed, DSWA will provide post-closure care, maintenance, and monitoring in accordance with the requirements of DRGSW § 5.K. In general, this will include: (i) operating the landfill to manage leachate, landfill gas, and surface water; (ii) monitoring ground water, surface water, and air at the site to detect releases of leachate, landfill gas, or waste; (iii) maintaining the leachate management, landfill gas management and surface-water management systems; and (iv) in the event of a problem, notifying the proper authorities of the problem and addressing the problem. DSWA's plan for providing post-closure operation, maintenance, and monitoring is presented in Section 6 of this Closure Plan. Further, DSWA plans to continue to use the site for other (as yet undetermined) solid waste management activities (e.g., recycling, composting, etc.) throughout the post-closure period.

The need for long-term maintenance of the landfill is described in Section 2.5. As described in Section 2.5 and as described in Section 6.6, after the first five years of post-closure care, the need for continued post-closure care will be reevaluated for each component of post-closure care (i.e., leachate management, landfill gas, groundwater monitoring, and capping system). The purpose of the reevaluation will be to support a request to the Department under DRGSW § 5.4K.1.C, that if post-closure care is no longer needed as described in this Post-Closure Plan, then it will be terminated or the length of post-closure care will be reduced.

2. METHODS, PROCEDURES, AND PROCESSES FOR LANDFILL CLOSURE

2.1 Introduction

In this Section, the methods, procedures, and processes that will be employed by DSWA to close the CIL disposal area are presented. The methods, procedures, and processes described in this section have been selected to meet the performance requirements of DRGSW § 5.J.1.a and b, which are:

- minimize the need for further maintenance of the landfill; and
- minimize the post-closure escape of solid waste, leachate, and landfill gases to the surface water, ground water, or atmosphere.

In the following sections, descriptions are provided of the methods, procedures, and processes that will be used to minimize the post-closure escape of solid waste (Section 2.2), leachate (Section 2.3), and landfill gas (Section 2.4) to the surface water, ground water, and atmosphere. Also, the need for long-term maintenance of the landfill is addressed (Section 2.5).

2.2 Containment of Solid Waste

The design of CIL provides for containment of solid waste throughout the entire period of landfill operation, closure, and post-closure care and minimizes the possibility for release of solid waste to the environment. Design features that will provide for containment of solid waste through the closure and post-closure period include: the liner system; the perimeter berm; the long-term interim cover; and the capping system. These features are described below.

- *Landfill Liner System.* The landfill liner system is designed to contain and to prevent a release of solid waste (including any liquid wastes that may exist in the landfill) to the environment. As shown on Drawing 42, the liner system will extend beneath all areas that will receive solid waste. The design and operation plan for CIL include techniques that are intended to minimize the possibility of damage to the liner system during the life of the landfill, including: (i) thorough construction quality assurance measures to identify and

remediate problems with the liner system during construction; (ii) specific operation measures for waste placement and cap construction that minimize the possibility of damage to the liner system; (iii) and monitoring of the landfill during operation and after closure to identify problems with the liner system. Using these techniques, the landfill will be effective in containing solid waste throughout the post-closure period.

- *Perimeter Berm.* The landfill is designed having a perimeter berm to provide containment of solid waste. The berm is illustrated on Drawing 37 through Drawing 41. As shown on the drawings, the berm is approximately 70 feet (21 m) high around the CIL disposal area. The berm is designed to provide stability to the landfill and to contain waste within the landfill cell. A large majority of the perimeter berm is constructed as a mechanically stabilized earth (MSE) berm. As shown on the drawings, the berm will be constructed in many areas having two tiers, an upper tier on which the landfill gas management system features and stormwater management features will be constructed and a lower tier on which the leachate removal and transmission system features will be constructed. The primary purpose of constructing the berm in tiers is to enhance stability. The landfill liner completely covers the interior of the wall, which together contain the solid waste within the landfill cell.
- *Interim Cover.* In some areas, DSWA may elect to construct an interim cover in areas where solid waste operations have ceased. In these areas, the cover would provide containment of waste and would limit the potential for excessive soil erosion, which could cause exposure and possibly a release of solid waste.
- *Capping System.* Two candidate capping alternatives are available for the site as described in Section 4 of the report prepared by Weston [1992] (see Volume 14). Selection of the appropriate capping system will be based on site conditions and the potential for the site to adversely impact the environment at the time of site closure.

2.3 Containment of Leachate

The design of CIL provides for containment of leachate throughout the landfill operation, closure, and post-closure care period and minimizes the possibility for

release of leachate from the landfill to the environment. Design features that will provide for containment of leachate throughout the closure and post-closure period include: (i) the landfill liner and leachate collection system; (ii) the leachate removal and transmission system; (iii) leachate treatment procedures; and (iv) the capping system. These features are described below.

- *Liner and Leachate Collection System.* The liner system and leachate collection system will provide containment of leachate throughout the post-closure care period. The liner system is illustrated on Drawing 42. As shown on Drawing 42, the liner system consists of either a natural soil liner (per DRGSW § 5.C.2.b) or a composite liner (per DRGSW 5.C.2.a). All areas will have a leachate collection system above the liner. The liner system is designed to minimize leakage of leachate into the environment; as described in Part VIb, Section 4.2 of the Permit Modification Application, the liner system has a calculated efficiency of over 99.9 percent. The leachate collection system is designed to route leachate from within the disposal areas to the perimeter of the landfill for removal. This system is designed to minimize the head of leachate (i.e., thickness of leachate) on the liner, and therefore will reduce the volume of leakage through the liner system.
- *Leachate Removal and Transmission System.* As described above, leachate will be transmitted from the disposal area to the perimeter of the landfill, where it will be removed from the landfill. The leachate removal system will be operated throughout the post-closure period to remove leachate that is collected in the sumps. The transmission system will act to route leachate from the landfill cell to the off-site Publicly-Owned Treatment Works (POTW) (which currently is the City of Wilmington Wastewater Treatment Plant). The transmission piping system will consist of a double-walled HDPE pipe and will have a secondary containment (i.e., witness) pipe. The double-walled piping system will allow detection of leakage within the piping system and will provide for containment of leachate outside of the landfill cell area.
- *Leachate Treatment System.* Throughout the post-closure period, leachate that is removed from the landfill will be transmitted to the POTW, where it will be treated to remove contaminants and then discharged in accordance with the POTWs discharge permit. If, at some point in the future leachate quality analysis indicates that constituent concentrations in the leachate meet

applicable discharge guidelines or can be treated passively (e.g., through a reed bed or wetland), then DSWA would petition DNREC to alter the treatment methods for leachate at the site according to the provisions and procedures described in Section 6.6 of this Closure Plan.

- *Capping System.* Two capping alternatives are available for the site as described in Section 4 of the report prepared by Weston [1992] (Volume 14). Regardless of the alternative selected, a cap will be constructed over all areas of the landfill that receive solid waste. The capping system will be maintained throughout the post-closure period. The cap will reduce the amount of infiltration that enters the landfill, thereby minimizing the amount of leachate that is generated during the post-closure period. The cap will also prevent the release of leachate from the landfill sideslopes in leachate 'break-outs'.

2.4 Containment of Landfill Gas

The design of CIL provides for containment of landfill gas throughout the landfill operation, closure, and post-closure care period and minimizes the possibility for release of landfill gas from the landfill to the environment. Design features that will provide for containment of landfill gas through the closure and post-closure periods include the landfill liner system, the capping system, and the active gas management system. These features are described below.

- *Landfill Liner System.* The landfill liner system will prevent the escape of landfill gas by eliminating the possibility of downward or lateral migration of landfill gas into the ground beneath the landfill and subsequent lateral migration of gas.
- *Final Capping System.* Two candidate capping alternatives are available for the site as described in Section 4 of the report prepared by Weston [1992] (Volume 14). Regardless of the alternative selected, the capping system will cover all waste throughout the post-closure care period and will be designed to prevent the discharge of landfill gas to the atmosphere at concentrations exceeding applicable state and federal emissions guidelines. The capping system will be tied into the liner system at the perimeter berm to provide complete containment of the landfill gas.

- *Active Landfill Gas Management System.* As described in Section 1.4.3, an active landfill gas management system will be constructed for CIL and will be operated as needed during the post-closure period. The system will consist of a network of vertical and horizontal wells to remove landfill gas, transmission pipes to convey the gas from the landfill, and a flare to burn landfill gas. The system will also be tied into other potential sources for release of landfill gas, such as the leachate riser pipes and the leachate cleanout pipes. The gas management system will be fully automated and will operate continuously at all times throughout the post-closure period.

2.5 Long-Term Landfill Maintenance

The CIL closure system has been designed to minimize maintenance throughout the post-closure period, as required by DRGSW § 5.J.1.a. Features of the design that minimize maintenance include:

- drainage terraces to limit the length of surface-water sheet flow off of the cap slopes and thus limit erosion of the final cap soils;
- relatively flat drainage channels and short downchutes (instead of long downchutes, culverts, or piping systems) to route drainage off the final cap at low, non-erosive velocities;
- gravity drainage of leachate (where possible) from the landfill to reduce the need for repair, replacement, or maintenance of leachate removal pumps;
- accelerated settlement (through the use of Prefabricated Vertical Drains or PVDs) at the perimeter of the landfill to reduce the amount of long-term maintenance needed for the leachate, landfill gas, and surface-water conveyance features;
- durable, hearty grasses for the cover that limit stormwater runoff and thus minimize erosion of the topsoil and vegetative support soil layers; and
- drainage features that transition gradually, instead of abruptly, to prevent concentrations of flow that could damage the cap.

3. PRE-CLOSURE ACTIVITIES

3.1 Overview

Pre-closure activities are defined in Section 1.3 as activities performed after cessation of waste disposal operations in parts of the landfill. Pre-closure activities will be performed in order to: (i) minimize generation of leachate and landfill gas at the site; (ii) enhance landfill gas collection prior to final closure; and (iii) enhance storm-water management. As described in Part VI (i.e., Operation and Maintenance Plan) of this Permit Modification Application, the landfill will be developed in several phases. As a result, at any point in time, different areas of the landfill may be closed, fully developed, partially-developed, or under construction. The phased development of the landfill is illustrated on Drawings 80 through 85 in Appendix VIb-A (i.e., Reduced Size Set of Permit Drawings) of this Permit Modification Application.

Pre-closure of the landfill may include any or all of the following activities:

- final landfill grading, as necessary to comply with the final cap system contours shown on Drawing 78 (i.e., Final Landfill Grading Plan);
- placement of interim cover over portions of CIL;
- placement of the final capping system over the surface of the previously-placed intermediate cover;
- revegetation of the final capping;
- construction of portions of the cover access roads and cover terraces;
- establishment of the surface-water drainage system on the final capping system; and
- installation of the landfill gas recovery wells and/or headers and connection of the headers to the landfill gas recovery system.

DSWA will evaluate site conditions on a continual basis and will perform pre-closure activities as required in order to meet the following goals: (i) minimize the generation of leachate requiring treatment and disposal; (ii) control landfill gas emissions; and (iii) minimize the need for maintenance of the landfill intermediate cover or final grading layer. DSWA will discuss specific pre-closure activities with DNREC before implementation.

3.2 Final Grading of Landfill

After the final receipt of waste in an area and before construction of the final cap, the surface of the landfill will be graded such that the computed post-settlement elevation of the intermediate cover layer is the required depth below the contours shown on Drawing 78 (i.e., Final Landfill Grading Plan). The purpose of final grading will be to provide smooth grades on the final cap, to repair any damage caused by erosion of the intermediate cover, to provide proper surface-water drainage for the cap, and to prepare the cap for construction of the capping system. DSWA will attempt to minimize the amount of final grading that is needed by filling CIL as closely as possible to the required grades.

3.3 Miscellaneous Relocation of Waste

During final grading of the landfill cover, some areas may require grading of waste in order to achieve the design final cover grades. Such grading may be needed to provide smooth slopes, to allow construction of cover access roads, or to provide proper drainage of cover terraces. If such grading is required, DSWA will excavate the waste, following the health and safety precautions as described in Part V (i.e., Operation Manual), and will identify areas of CIL to receive the waste. Relocated waste will be covered with daily and intermediate cover (i.e., 0.5-ft (0.15-m) thick layer of cover soil) before the end of the day that it is relocated.

3.4 Interim Cover

Based on the specific needs of DSWA, after an area has been filled to the computed post-settlement final grades as shown on Drawing 78 (i.e., Final Landfill Grading Plan) DSWA may elect to place an interim cover over parts of the landfill. As described in Section 1.3 of this Part, the purposes of placing the interim cover would be to: (i) control landfill gas; (ii) minimize the amount of infiltration into the landfill; and (iii) minimize the amount of maintenance needed for intermediate cover or final grading layer surfaces. Also, because it can be easily removed (as described below), use of an interim cover may allow inexpensive access to the waste for possible alternative uses (e.g., waste-to-energy fuel, recycling, or landfill overfilling). The interim cover systems would include a relatively low-permeability soil layer over the intermediate cover layer or final grading layer or other interim cover approved by DNREC.

4. DESCRIPTION OF CLOSURE SYSTEM COMPONENTS

4.1 Introduction

The closure system will consist of several components, including a capping system, a landfill gas management system, and a surface-water management system. The currently permitted capping system will be used and a description of the capping components can be found in the report prepared by Weston [1992] (Volume 14 of this Permit Modification Application). The leachate management system, which will be operated during the post-closure period, is not considered to be a closure system component because it will have already been constructed and in operation before final closure. In this section, the capping, gas management, and surface-water management components of the closure system are described.

4.2 Landfill Gas Control System

Landfill gas will be controlled by removing the gas from the landfill through an active gas collection system and then routing the gas to a flare. As described in Part VIb, Section 4.4 of this Permit Modification Application, enhancements to the permanent system will be installed, if needed, to control landfill gas after closure of the landfill. The active gas collection system will be operated until active emission control is no longer necessary. Gases will be prevented from escaping the landfill by the capping system. Regardless, a gas monitoring program (which is described in Section 6.4.4 of this Closure Plan) will be implemented to test for the presence of landfill gases outside of the landfill.

4.3 Surface-Water Management System

At closure, the surface-water management system will be modified to meet the goals of post-closure care. During operation of the landfill, the system will have the dual purposes of: (i) managing stormwater; and (ii) minimizing erosion and off-site sedimentation. After closure, the primary purpose of the system will shift from erosion and sediment control (because all surfaces will be stabilized with vegetation) to storm-water management (i.e., conveyance of stormwater in a non-erosive manner to the Delaware or Christina Rivers). To modify the storm-water management system for long-term post-closure use, the low-flow sediment dewatering devices will be removed and the sediment will be cleaned from the basins.

5. COST ESTIMATES

5.1 Introduction

In this section, cost estimates are presented for CIL final closure system construction and post-closure care. The cost estimates are presented to address the requirements of DRGSW § 5.J.3.d. Costs for construction of CIL, operation of CIL, and any activities related to interim closure or pre-closure of CIL are not addressed in this estimate.

5.2 Closure Construction Cost Estimate

Estimates of capital closure costs for the 24-in. thick clay cover capping system and the geomembrane cover system are included in Table 1. The closure cost estimates include those costs that will be incurred during: (i) construction of the 40-acre (16-ha) area final capping system for CIL; (ii) removal of construction equipment from the site; and (iii) establishment of the permanent landfill gas management system enhancements. As shown on Table 1, the estimated cost in 2003 dollars is \$4,800,000 for the 24-in. thick clay cover and \$4,510,000 for the geomembrane cover.

5.3 Post-Closure Care Cost Estimate

An estimate of the post-closure cost for maintenance of the candidate closure systems for the CIL is presented in Table 2. The post-closure cost estimate includes the cost of:

- environmental quality monitoring (i.e., sampling and analysis of ground water, surface water);
- inspections of the final cap system, gas control system, storm-water management system, leachate collection system, and perimeter road;
- leachate removal, storage and hauling; and
- maintenance of the above-referenced systems.

As shown on Table 2, the estimated cost of post-closure care in 2003 is \$8,098,000 for the 24-in. thick clay cover and \$7,846,000 for the geomembrane cover. The

estimate is based on a post-closure care period of 30-years as required by DRGSW § 5.K.1.a.

5.4 Financial Assurance

The DSWA provides documentation of compliance with the requirements of a State-approved Financial Assurance Mechanism for closure and post-closure care by 31 December of each year. This certification is provided for the DSWA's most recent fiscal year, which ends on 30 June of each year. A copy of the most recent certification, dated 9 December 2003, is provided in Appendix XI-1. The financial assurance certification for the next year (i.e., to be submitted by 31 December 2004) will be based on the least expensive DNREC-approved closure and post-closure care option for the facility. As described in Sections 5.2 and 5.3, the closure and post-closure cost estimates for the two cover alternatives are provided in Tables 1 and 2, respectively.

6. POST-CLOSURE CARE

6.1 Regulatory Requirements

This post-closure care plan addresses the requirements of DRGSW § 5.J.3.e and 5.K. As required by DRGSW § 5.K.2, maintenance will be performed for the cap system, all vegetation associated with CIL, the leachate management system, the ground-water monitoring system, the landfill gas management system, the storm-water management system, and other miscellaneous site features, as described below. An inspection schedule for post-closure maintenance is presented in Table 3. In addition, ground water, storm water, leachate, and landfill gas will be monitored as described in Section 6.4. In this section, operation, maintenance, and monitoring of the landfill throughout the 30-year, post-closure care period are described.

6.2 Post-Closure Operation

During the post-closure care period, leachate and landfill gas will continue to be generated at the landfill. Accordingly, the leachate management system and the landfill gas management system will be operated, maintained, and monitored routinely as described in the Operation and Maintenance Manual, (i.e., Part V of this Permit Modification Application). Other features of the landfill will only be maintained and monitored. Operation of the leachate and landfill gas management systems will be performed according to the procedures described in the Operation and Maintenance Manual until such time that leachate and landfill gas are either not produced or are produced in limited quantities or with limited concentrations such that they are not harmful to human health or the environment. At that time, DSWA will demonstrate to DNREC (using the approach described in Section 6.6 of this Closure Plan) that management of leachate and landfill gas is no longer necessary and, upon DNREC's approval, will cease operation of the leachate and landfill gas management systems.

6.3 Post-Closure Maintenance

6.3.1 Access Roads

On-site access roads will be maintained in a passable condition at all times during the post-closure period. As shown on the engineering plans, all access roads will have

gravel surfaces except for the entrance access road, which will be paved. All access roads will be inspected quarterly for conditions that would prevent passage of vehicles (such as ruts, ponded water, washouts, gullies, ice or other frozen precipitation, or obstacles). If needed, repairs will be made to keep the roads passable.

6.3.2 Vegetation

Vegetation (including permanent and screening vegetation) will be maintained in a condition that will minimize erosion of on-site soils and will help screen the site from public view. During the post-closure period, maintenance will consist of inspections, quarterly and after major storm events (i.e., 24-hour, 10-year or greater storm return frequency), to identify locations of excessive erosion, washout, poor vegetation density, and damaged vegetation. If required, the identified areas will be regraded and/or revegetated.

During landscaping inspections, all on-site slopes will be inspected for stability. The inspector will attempt to identify any signs of sloughing of the slope surface, bulging at the toes of slopes, tension cracks at the tops of slopes, and other conditions that may indicate slope instability. If areas of instability are identified, DNREC will be notified and appropriate remedial measures will be implemented.

6.3.3 Mechanically Stabilized Earth Walls

The mechanically stabilized earth (MSE) walls will be maintained in a condition that ensures waste and leachate will be contained and the structural integrity of the wall is not compromised. During the post-closure period the MSE wall will be inspected periodically to identify signs of leakage, cracks or stress, and slumping or sliding. Maintenance of the MSE wall may require additional reinforcement or replacement of component parts to ensure continued operation.

6.3.4 Surface-Water Management System

The surface-water management system, consisting of all surface-water drainage ditches (both permanent and temporary), culverts, sedimentation basins, and associated sedimentation basin structures, will be maintained in a condition that allows continuous

control of surface water at the site. During the post-closure period, all drainage ditches, culverts, and storm-water basins will be inspected quarterly and after major storm events (i.e., 24-hour, 10-year or greater storm return frequency) for conditions that would restrict flow, such as:

- washouts;
- excessive sediment in ditches or culverts;
- dislodged riprap; or
- gullies or erosion.

Washouts, excessive erosion, and gullies will be repaired by regrading the areas to the proper elevations (as shown on the engineering plans), revegetating, or applying rip-rap. Ditches having excessive deposits of sediment (i.e., 8 in. (20 cm) in depth or greater) will be cleaned. Dislodged rip-rap will be replaced as necessary.

6.3.5 Leachate Collection System

Routine maintenance will be performed on the leachate collection system to prevent clogging of the system. Maintenance will consist of cleaning all accessible leachate collection pipes (identified on Drawing 45). Cleaning will be performed annually during the post-closure period (unless experience indicates a lesser cleaning frequency is acceptable) until the leachate collection and leachate transmission, removal, and storage systems are taken out of service (as described in Section 6.6 of this Closure Plan).

6.3.6 Leachate Removal and Transmission

The components of the leachate removal and transmission system will be routinely inspected and maintained during the post-closure period to ensure that the system functions properly and that leachate is not released to the environment. Inspections of the leachate removal and transmission system (i.e., leachate pumps, riser houses, and leachate transmission lines) will be performed quarterly to check for malfunctioning pumps, broken lines, malfunctioning meters and valves, and damaged leachate riser

houses. In addition, the electrical controls for the leachate transmission system will be checked to ensure that they are functioning properly.

Leachate will be sampled quarterly and will be tested to determine the concentration of chemical constituents. If, during the post-closure period, the chemical constituents in the leachate do not exceed the parameters concentrations identified in the permit for the facility, then the leachate collection system will be taken out of service. However, the leachate collection system will be left in place in the event that these features are needed at a future date.

6.3.7 Landfill Gas Removal System

The landfill gas removal system will be routinely inspected and maintained to provide continuous collection, transmission, and destruction of landfill gas at the site. Gas recovery and transmission system components (including well heads, header pipes, condensate wells, connections between the wells and final cap geomembrane, (if the geomembrane cover alternative is used) and the flare station) will be inspected on a quarterly basis during the post-closure period for signs of damage to the components and for evidence of leaks in the gas transmission lines. Based on experience with similar gas management systems at other DSWA facilities, routine maintenance involves tightening or replacement of fittings and occasional replacement of well heads. Details of maintenance procedures for the landfill gas management system are included in Part V (i.e., Operation and Maintenance Manual) of this Permit Modification Application.

6.3.8 Environmental Monitoring System

All components of the environmental monitoring system (including ground-water monitoring wells, surface-water monitoring stations, leachate monitoring ports, and gas monitoring locations) will be inspected during each sampling event. The components will be inspected for damage and will be repaired or replaced, if necessary.

6.3.9 Miscellaneous Site Activities

Maintenance of other site features will be performed during the post-closure period on a routine basis, as described below.

- The site perimeter fence will be inspected quarterly for breaks in the fence and to ensure that the gates are working properly. The fence and gates will be repaired as needed to provide continuous access control around the entire site.
- The scales (if still in operation) will be inspected and calibrated at least annually.
- Buildings (including the office building, scale house, and maintenance building) will be inspected annually and will be maintained to provide continuous support for landfill maintenance and monitoring activities.

Also, as required by DRGSW § 5.K.3:

- standing water will not be allowed to accumulate on the landfill;
- open burning will not be performed on the landfill;
- no activity that has not been approved in advance by DNREC will be performed at the landfill; and
- access to the landfill will be limited to only those persons who are engaged in approved post-closure activities.

6.4 Post-Closure Monitoring

6.4.1 Introduction

In this section, the activities that DSWA will perform to monitor the site throughout the post-closure care period are described. These activities include ground-water, surface-water, landfill gas, and leachate monitoring. The sampling and analysis for environmental monitoring services will be performed either by DSWA or by its contractor. Presented in the following sections are the specific monitoring procedures that are required by DRGSW § 5.D.4, 5.E.3, 5.F.4, and 5.G.

6.4.2 Ground-Water Monitoring

Ground water will be monitored throughout the post-closure care period, as required in DRGSW § 5.G and as specified in the permit. The site-specific groundwater monitoring requirements will be reviewed periodically during the post closure period.

- All monitoring wells will be maintained and protected in accordance with the *"Regulations Governing the Construction of Water Wells"*.
- Abandonment of monitoring wells due to construction activities will be performed in accordance with the terms of *"Regulations Governing the Construction of Water Wells."*

6.4.3 Surface-Water Monitoring

Surface water will be monitored to evaluate compliance with the requirements of DRGSW § 5.F.4. Surface water monitoring will be performed in accordance with the requirements of the permit.

6.4.4 Landfill Gas Monitoring

Landfill gas will be monitored as required by DRGSW § 5.E.3. The control and management of landfill gas will be performed in conformance with: (i) the Delaware Regulations Governing the Control of Air Pollution; (ii) the DRGSW; and (iii) the Landfill Gas Monitoring Plan for the site that will be prepared within 60 days from issuance of the permit. Also, as shown in Part V (i.e., Operation and Maintenance Manual) of the Permit Modification Application, odors will be prevented from escaping the site boundary through the use of engineered collection and/or combustion systems. The post-closure gas monitoring procedures are described below.

- Gas monitoring will be performed: (i) in confined spaces (i.e., buildings on the landfill property within 1,000 ft (300 m) of the landfill) and (ii) outside the landfill in either gas monitoring probes or ground-water monitoring wells that have screen intervals above the water table.

- Gas monitoring parameters will include at least methane and oxygen.
- After DNREC issues a permit, DSWA will submit a gas-monitoring plan for approval. Gas monitoring will then be conducted in accordance with the approved monitoring plan.
- Results of gas monitoring will be submitted to DNREC as part of the annual report for the facility.

6.4.5 Leachate Monitoring

Leachate will be monitored as required by DRGSW § 5.D.4. The specific post-closure leachate monitoring procedures are described below.

- The leachate monitoring system is designed to measure the rate and quantity of leachate flow and is designed to allow sampling of the leachate; such measurements and samples will be made during the post-closure care period.
- Within 45 days following the issue of a permit, DSWA will submit a leachate-monitoring plan to the Department for approval for monitoring of leachate. Such plan will include the sampling locations, frequency and analytical requirements as well as quality control and quality assurance procedures. Leachate monitoring will be performed throughout the post-closure period in accordance with the approved plan..
- Test methods used to analyze samples will be those described in the most current legal edition of EPA Publication SW-846 "Test Methods for Evaluating Solid Waste – Physical and Chemical Methods". If SW-846 does not contain a test method for a required parameter, that parameter will be tested according to methods described in the most recent edition of the EPA Publication "Methods of Chemical Analysis for Water and Wastes" or of Standard Methods for Examination of Water and Wastewater.

6.4.6 Geotechnical Monitoring

Geotechnical monitoring will be conducted throughout the post closure care period. Geotechnical monitoring will include periodically obtaining readings from on site instruments including piezometers, settlement plates, and inclinometers. A Geotechnical Monitoring Plan has been prepared and is included in Part V (i.e., Operation and Maintenance Manual) of this Permit Modification Application. The Geotechnical Monitoring Plan describes the monitoring locations, procedures, and frequency that will be employed throughout the post-closure period.

6.5 Post-Closure Use

The future use of the CIL site is discussed in this section as required by DRGSW § 5.J.3.e.(3). In addition to landfill operations, the site may be used for composting, wood chipping, and recycling operations. Other than continued landfill operations, DSWA currently plans to use the site in the future for idle grassed and forested land.

6.6 Duration of Post-Closure Care

Post-closure care will be provided in accordance with the requirements of DRGSW § 5.K.1. In this section of DRGSW, the general requirements for post-closure care are defined, including specific post-closure care activities and the duration of the post-closure care period. The requirements of DRGSW § 5.K.1 regarding the duration of post-closure care include the following:

- the duration of post-closure care will be 30 years after the completion of closure;
- the Department may remove required elements of the post-closure care plan if it determines that they are no longer needed to protect human health and the environment;
- at any time after the first five years of the post-closure period, the Department may reduce the length of post-closure care if it determines that such care is not needed to protect human health and the environment;

- prior to the end of post-closure care, the Department may extend the post-closure care period if it determines that an extended period is necessary to protect human health and the environment; and
- the Department will require actions to mitigate threats to human health and the environment if evidence exists of a contaminant release that could significantly threaten human health or the environment.

Based on these requirements, a performance-based approach will be applied to the duration of post-closure care at the CIL. In general, this will consist of implementing the following approach.

- First, the requirements of the Post-Closure Care plan (i.e., as described in Sections 6.1 through 6.5 of this Plan) will be implemented beginning at the completion of closure.
- At any time after the first year of post-closure care, an evaluation will be made of the need to continue post-closure care for each of the four components of post-closure care (i.e., leachate management, landfill gas management, groundwater monitoring, and cap system). The approach for evaluating the need for continued post-closure care is outlined in Table 4. Depending on the outcome of the evaluation, the post-closure care plan may be revised so that it better reflects the actual threat of the landfill to human health and the environment.
- If changes are made to the post-closure care plan as a result of the evaluation of the need for continued post-closure care, then a demonstration will be made to DNREC that the changes are reasonable based on the available information and the evaluations. No changes in post-closure care will be made before DNREC formally approves such changes to the Closure Plan and the permit for the facility. If the outcome of the evaluation is inconclusive (e.g., no change to the post-closure care plan is indicated by the data and evaluations), then post-closure care will continue as required in the post-closure plan.
- Additional evaluations of the need for continued post-closure care may be performed when additional data exist that could result in a different outcome

of the evaluation. This includes evaluation outcomes that could indicate the need for a longer post-closure period or additional elements of the post-closure plan.

6.7 Facility Contact

The facility contact is as follows:

Ms. Robin M. Roddy, P.E.
Northern Solid Waste Management Center
Cherry Island Landfill
1706 E. 12th Street
Wilmington, Delaware 19809
Phone: (302) 764-5385
Fax: (302) 764-5386

7. LANDFILL GAS CONTROL PLAN

7.1 Introduction

A gas control and monitoring system will be installed and maintained at CIL to address the requirements of DRGSW § 5.E. In general, the gas control system will be operated in a manner that:

- removes gas from CIL and prevents accumulation of gas at either on-site or off-site locations;
- prevents releases of gas that could cause damage to vegetation; and
- prevents landfill gas odors at or beyond the CIL property boundary.

In this section, the landfill gas control system is described and the manner in which the system addresses the requirements of DRGSW § 5.E. is described.

7.2 Description of Landfill Gas Control System

Landfill gas will be managed by removing the gas from the landfill through an active gas collection system and then routing the gas to a flare. As described in Part VIb, Section 4.2 of this Permit Modification Application, a permanent system will be installed, if needed, to control landfill gas after closure of the landfill. The active gas collection/flaring system will be operated until the post-closure maintenance of the landfill facility ceases. Gases will be prevented from escaping the landfill by the liner and cover systems. Still, a gas monitoring program (presented in Section 6.4.4 of this Closure Plan) will be implemented to test for the presence of landfill gases outside of the landfill.

7.3 Landfill Gas Monitoring

Landfill gas monitoring will be performed as required by DRGSW § 5.E.3. Landfill gas monitoring activities are described in Section 6.4.4 of this Closure Plan.

7.4 Response Actions

In the event that landfill gas is detected in facility structures or at the property boundary in excess of 25 percent of the LEL, then the following response activities will be performed:

- take immediate steps to protect human health and the environment;
- immediately notify DNREC;
- within seven days of detection, place a note in the operating record that states the levels detected and the steps taken to protect human health and the environment; and
- within 60 days of detection, implement a plan to remediate the release, place a copy of the plan in the operating record, and notify DNREC that the plan has been implemented.

The remediation plan described above will contain a description of the following:

- the nature of the problem;
- the extent of the problem, including work performed by DSWA to evaluate the extent of the problem; and
- a proposed remediation plan, including the engineering analyses performed to estimate the effectiveness of the proposed solution.

8. REFERENCES

Scheutz, C. and Kjeldsen, P., (2002) *"Methane Oxidation of Organic Compounds in Landfill Cover Soils"* Proceedings of the 25th Annual Landfill Symposium, SWANA, Monterey, CA, March 25-28, pp.115-123.

TABLE 1

FINAL CLOSURE CONSTRUCTION COST ESTIMATE ^{1,2}

Cherry Island Landfill Expansion Project
Wilmington, Delaware
DSWA Contract No. S01445NC

Item No.	Description	Units	Quantity	Unit Price (\$)	24" Clay Cover Cost (\$)	Geomembrane Cover Cost (\$)
1	Mobilization	Lump sum	1	100,000	100,000	100,000
2	Site preparation	Acre	40	2,500	100,000	100,000
3	Fine grading of existing intermediate cover	Acre	40	1,500	60,000	60,000
4	Improvements and maintenance to sediment ponds and sediment traps	Lump sum	1	50,000	50,000	50,000
5	Furnish and install 24" clay cap at 1×10^{-7} cm/sec	CY	129,040	15.00	1,936,000	N/A
6	Furnish and install 18" stabilized sludge protective cover layer	CY	96,780	8.00	774,200	774,200
7	Furnish and install 6" topsoil layer	CY	32,260	25.00	806,500	806,500
8	Furnish and install geocomposite drainage layer	SF	1,742,400	0.30	N/A	522,700
9	Furnish and install geomembrane cover	SF	1,742,400	0.35	N/A	609,800
10	Furnish and install geotextile cushion layer	SF	1,742,400	0.21	N/A	365,900
11	Construct and install anchor trench	LF	4,000	7.00	N/A	28,000
12	Construct and install geomembrane boots for gas collection wells and geotechnical instruments	acre	40	3,000	N/A	120,000
13	Furnish, install, maintain, and remove temporary erosion and sediment control devices	Lump sum	1	75,000	75,000	75,000
14	Furnish and install permanent seed and mulch	Acre	40	1,750	70,000	70,000
15	Repair and complete permanent gravel access road	CY	2,000	29.00	58,000	58,000
16	Active gas collection system improvements (wells and electrical system) – by Contractor	Lump sum	1	150,000	150,000	150,000
17	Remove Temporary Ditches, Adjacent Temporary Protection, and Section of Geocomposite	LF	4,000	5.00	20,000	20,000
18	Construction quality assurance field work and reporting	Lump sum	1	400,000	400,000	400,000
19	Project surveying	Lump sum	1	100,000	100,000	100,000
20	Demobilization	Lump sum	1	100,000	100,000	100,000
TOTAL:					\$4,800,000	\$4,510,000

Notes:

- 1 Cost Estimate is based on an assumed final closure construction area of 40 acres.
- 2 Cost Estimate is based on previously approved final cover cross-section

TABLE 2
POST-CLOSURE COST ESTIMATE

Cherry Island Landfill Expansion Project
Wilmington, Delaware
DSWA Contract No. S01445NC

	<u>24" Clay Cover</u>	<u>Geomembrane Cover</u>
1. ENVIRONMENTAL MONITORING		
a. Semi-Annual		
i. Sampling (2 events for 30 years at \$3,000 each)	\$180,000	\$180,000
ii. Shipping (2 events for 30 years, 15 samples at \$110 each)	99,000	99,000
iii. Analyses (2 events for 30 years, 15 samples at \$850 each)	765,000	765,000
b. Annually		
i. Sampling (included in semi-annual sampling)	0	0
ii. Shipping (1 event for 30 years, 12 samples at \$110 each)	39,600	39,600
iii. Analyses (1 event for 30 years, 12 samples at \$1,500 each)	540,000	540,000
Item 1 Subtotal:	\$1,623,600	\$1,623,600

TABLE 2
POST-CLOSURE COST ESTIMATE
(continued)

	<u>24" Clay Cover</u>	<u>Geomembrane Cover</u>
2. INSPECTIONS		
a. Quarterly cover inspection (120 inspections, 4 hrs each at \$50/hr)	\$24,000	\$24,000
b. Quarterly landfill gas recovery system inspection (120 inspections, 4 hrs each at \$50/hr)	24,000	24,000
c. Quarterly storm-water management system inspection (120 inspections, 4 hrs each at \$50/hr)	24,000	24,000
d. Annual leachate collection system inspection (30 inspections, 8 hrs each at \$50/hr)	12,000	12,000
e. Quarterly leachate removal and transmission system inspection (120 inspections, 4 hours each at \$50/hr)	24,000	24,000
f. Quarterly leachate recirculation system inspection (120 inspections, 4 hrs each at \$50/hr)	24,000	24,000
g. Quarterly perimeter and road inspections (120 inspections, 4 hrs each at \$50/hr)	24,000	24,000
Item 2 Subtotal:	\$156,000	\$156,000

3. LEACHATE MANAGEMENT

24" Clay Cover: Estimate the post-closure leachate generation rate to be approximately 110 gallons per acre per day. Total 30-year leachate production equals approximately 301,125,000 gallons. Leachate transport and treatment costs (gallons at \$0.0023/gallon).

TABLE 2
POST-CLOSURE COST ESTIMATE
(continued)

	<u>24" Clay Cover</u>	<u>Geomembrane Cover</u>
Item 3 Subtotal for 24" Clay Cover	\$692,600	
<p>Geomembrane Cover: Estimate the post-closure leachate generation rate to be approximately 70 gallons per acre per day. Total 30-year leachate production equals approximately 191,625,000 gallons. Leachate transport and treatment costs (191,625,000 gallons at \$0.0023/gallon).</p>		
Item 3 Subtotal for Geomembrane Cover:		\$440,700
4. MAINTENANCE		
a. Leachate transmission system		
i. Pump replacement (replace each of 6 pumps once every 10 years for 30 years or 18 pumps at \$20,000 each)	\$360,000	\$360,000
ii. Meter replacement (replace each of 3 control panels once during post-closure at \$4,500 each)	13,500	13,500
iii. Flush system (once per year for 30 years at \$3,000 per flushing)	90,000	90,000
Subtotal (4a):	\$463,500	\$463,500
b. Surface and ground water monitoring		
i. Well replacement (replace each of 2 wells once at \$4,000 per well)	\$8,000	\$8,000

TABLE 2
POST-CLOSURE COST ESTIMATE
(continued)

	<u>24" Clay Cover</u>	<u>Geomembrane Cover</u>
ii. Well maintenance, miscellaneous (\$1,000 per year for 30 years)	30,000	30,000
Subtotal (4b):	\$38,000	\$38,000
c. Surface water controls/cover regrading (assume that any necessary grading can be performed in one week per year; rent equipment for regrading and surface ditch sediment removal):		
i. 1 CAT D-4 Dozer (\$860/day, 5 days/yr, for 30 years)	\$129,000	\$129,000
ii. 1 CAT 953 Loader (\$1,080/day, 5 days/yr, for 30 years)	162,000	162,000
iii. 1 Dump truck (15 cy) (\$540/day, 5 days/yr, for 30 years)	81,000	81,000
iv. 1 Crew with foreman, 1 laborer (\$480/day, 5 days/year, for 30 years)	72,000	72,000
Subtotal (4c):	\$444,000	\$444,000
d. Final Cover Maintenance		
i. Assume that equipment on-site for surface water/cover controls can also perform final cover repairs	_____	_____

TABLE 2
POST-CLOSURE COST ESTIMATE
(continued)

	<u>24" Clay Cover</u>	<u>Geomembrane Cover</u>
ii. Assume cover repair/soil amendment requirements of approximately one foot over 5% of the entire cover: (5%)(1 ft) (250 acres) = 20,167 cy from the removed sedimentation @ \$6/cy for 30 years)	\$3,630,000	\$3,630,000
iii. Assume that 2% of the site requires revegetation each year (2%)(250 acres)(\$5,000/acre for 30 years)	\$750,000	\$750,000
Subtotal (4d):	\$4,380,000	\$4,380,000
e. Landfill Gas Management and Leachate Recirculation System	\$300,000	\$300,000
Subtotal (4e):	\$300,000	\$300,000
Item 4 Subtotal:	\$5,626,000	\$5,626,000
TOTAL POST-CLOSURE OPERATION COST FOR 30 YEARS (2003 DOLLARS):	\$8,098,000	\$7,846,000

TABLE 3
POST-CLOSURE
MAINTENANCE INSPECTION SCHEDULE

Cherry Island Landfill Expansion Project
Wilmington, Delaware
DSWA Contract No. S01445NC

<u>Item</u>	<u>Inspection Frequency</u>
Access Roads	Quarterly
Vegetation	Quarterly and after major storm events ¹
Storm-Water Management System	Quarterly and after major storm events ¹
Equipment	Monthly
Leachate Collection System	Annually
Leachate Removal Transmission System	Quarterly
Leachate Storage Area	Daily (during use)
Landfill Gas Recovery System	Quarterly
Environmental Monitoring System	During sampling events
Security Fence and Signs	Quarterly
Perimeter Fence	Quarterly
Landfill Scales	Annually
Buildings	Annually

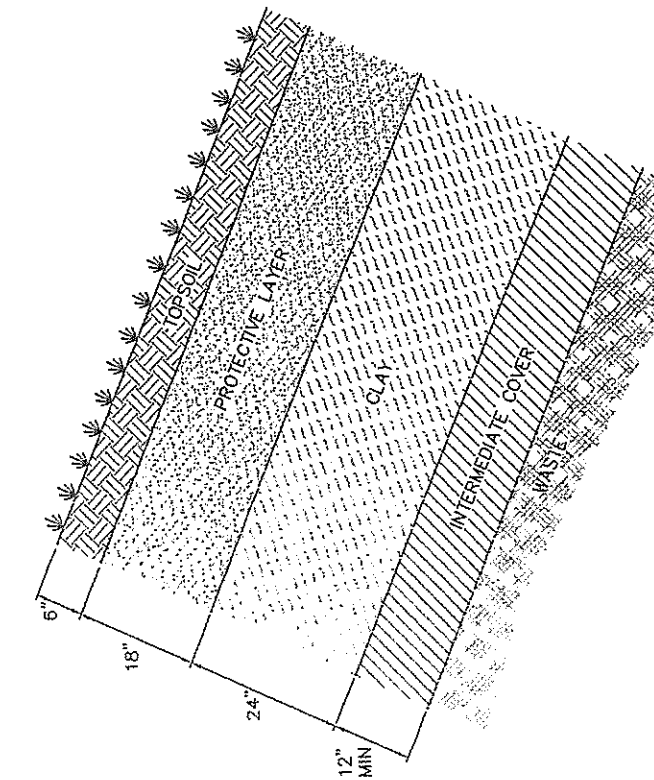
Note: ¹ "Major storm events" are defined as the 24-hour, 10-year or greater storm return frequency.

TABLE 4

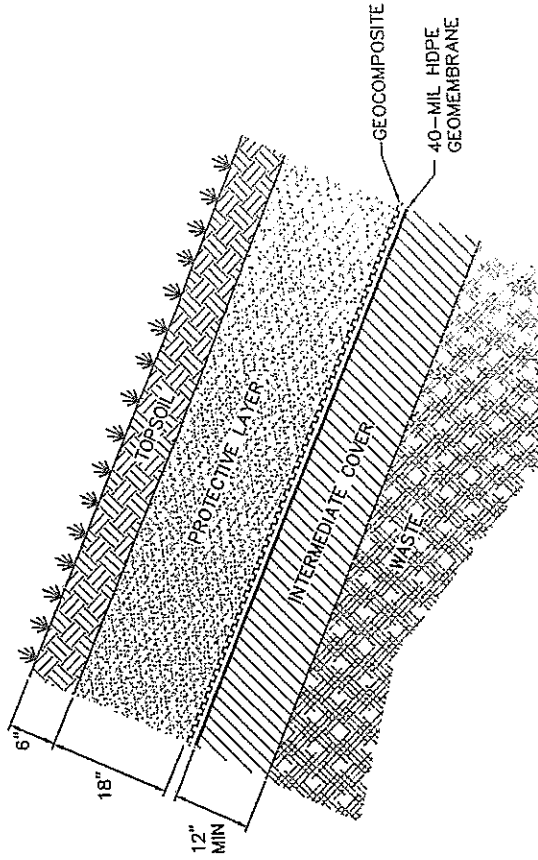
APPROACH FOR EVALUATING NEED FOR CONTINUED POST-CLOSURE CARE

Cherry Island Landfill Expansion Project
Wilmington, Delaware
DSWA Contract No. S01445NC

Component of Post-Closure Care (PCC)	Purpose of PCC Component	Criteria for Demonstrating that PCC Component is no Longer Necessary (as per DRGSW §5.1C.1.e)	Demonstration Approach
Leachate Management System (LMS)	Contain and treat leachate to prevent adverse impacts of leachate to surface water and ground water.	No risk of impacts from uncontrolled releases of leachate. In addition, operation of LMS must not be necessary to maintain geotechnical stability.	Show that uncontrolled releases of leachate of current quality and quantity will not violate water quality standards in receiving surface-water or groundwater. Also, show that geotechnical stability is not affected.
Landfill Gas Management System	Control of potential impacts of landfill gas with regard to: <ul style="list-style-type: none"> • Compliance with Clean Air Act; • Lateral migration (explosive potential); • Groundwater / Vadose Zone; and • Odor. 	No potential for future violation of DRGSW § 5.E.1.b. (i.e., no potential for lateral gas migration problems) and no potential for future exceedance of Clean Air Act standards.	Show that annual volume and quality of gas generated at site is such that elimination of gas management will not result in violation of DRGSW § 5.E.1.b. or any other applicable Federal or State regulation or permit requirement.
Groundwater Monitoring System	Verify that there are no unacceptable impacts to groundwater from leachate release or gas migration from site.	Status of leachate and gas evaluations is such that potential impacts to groundwater are acceptable (i.e., time required for impacts to have been detected has passed).	Confirm that ground-water monitoring has been performed at least as long as the time required for impacts for hypothetical leachate and gas release to have been detected at compliance location.
Cover System	Control of one or more of the following: <ul style="list-style-type: none"> • Infiltration (i.e., generation of leachate); • Gas emission / migration; • Direct exposure to waste; and/or • Geotechnical stability. 	Loss of, or changes to, cover integrity must not adversely affect any of the purposes listed. Long-term condition of cover must be compatible with end-use obligations for the site.	Evaluate effect of cover integrity on all other aspects of PCC and end-use. Ensure compatibility between cover maintenance program and requirements for cover from other PCC components.



1A
—
DETAIL
COVER ALTERNATIVE 1
SCALE: NONE
(SEE NOTE)

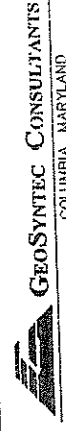


1B
—
DETAIL
COVER ALTERNATIVE 2
SCALE: NONE
(SEE NOTE)

NOTES:

1. THE PROTECTIVE LAYER SHALL CONSIST OF RELATIVELY HOMOGENEOUS, NATURAL SOILS THAT ARE FREE OF DEBRIS, FOREIGN OBJECTS, EXCESS SILT, ROOTS, AND ORGANICS. SOIL SHALL BE CLASSIFIED AS SM, SC, ML OR CL BY THE USCS AND SHALL HAVE A MAXIMUM PLASTICITY INDEX OF 25, AS DETERMINED IN ACCORDANCE WITH ASTM D 4318.

CAPPING SYSTEM ALTERNATIVES



PROJECT NO.	ME0250	FILE NO.	0250F1501
DOCUMENT NO.		FIGURE NO.	1

APPENDIX XI-A



DELAWARE SOLID WASTE AUTHORITY

Board of Directors
Richard V. Pryor
Chairman
Ronald G. McCabe
Vice Chairman
J. Donald Isaacs
Theodore W. Ryan
Phyllis M. McKinley
William J. DiMondi

N. C. Vasuki, P.E., DEE
Chief Executive Officer

Pasquale S. Canzano, P.E., DEE
Chief Operating Officer

December 30, 2003

Ms. Nancy Marker
Program Manager II
Solid & Hazardous Waste Management Branch
DNREC
89 Kings Highway
P.O. Box 1401
Dover, DE 19903

RE: Financial Assurance Mechanism Certification - GASB 18

Dear Ms. Marker:

Attached please find the documentation necessary to certify DSWA's compliance with the requirements of the state approved Financial Assurance Mechanism for Closure and Post-Closure Care. The certification is for the Fiscal Year ending June 30, 2003.

The Audited Financial Statements submitted as part of the certification documentation have not been officially issued by the Board of Directors and therefore are marked draft. When the Board officially issues the financial statements you will be forwarded a clean copy. There are no anticipated changes to the current draft.

As of June 30, 2003, the DSWA has no outstanding bonded debt on its books, thus there are no bond rating confirmations from the rating agencies.

If you have any questions please feel free to contact me.

Sincerely,

Ronald J. Peters, Sr.
Chief Financial Officer

\\hblc:\win\finasap03.rjp

cc: N. C. Vasuki, P.E., DEE
P. S. Canzano, P.E., DEE
✓ R. P. Watson, P.E., DEE
T. E. Houska, P.E.

1128 S. Bradford Street, P.O. Box 455, Dover, Delaware 19903-0455
Phone: (302) 739-5361 Fax: (302) 739-4287

CITIZENS' RESPONSE LINE: 1-800-404-7080

www.dswa.com

CERTIFICATION OF COMPLIANCE
WITH FINANCIAL ASSURANCE MECHANISM
FOR CLOSURE AND POST CLOSURE CARE COSTS

I, Ronald J. Peters, Sr., Chief Financial Officer of the Delaware Solid Waste Authority, do hereby certify that the Delaware Solid Waste Authority has:

- 1) No outstanding bonds as of June 30, 2003.
- 2) Received an unqualified opinion from its independent auditor following their audit of the financial statements of the Authority for the fiscal year ended June 30, 2003. The audit was conducted in accordance with all applicable GAAP and GAAS standards for governmental entities (Exhibit 1).
- 3) Calculated its liability for closure and post closure care costs in accordance with GASB Statement No. 18 and this liability has been fully disclosed in the Authority's audited financial statements for the fiscal year ended June 30, 2003.

WITNESS:

Julian H. Baker

SIGNED:

Ronald J. Peters, Sr.

DATE:

12-9-03

RECEIVED
DEC 16 2002

DSWA



Moody's Investors Service

99 Church Street
New York, New York 10007

Renée Boicourt
Managing Director
Infrastructure, State & High Profile
Ratings Group

Tel: 212.553.7162

Fax: 212.553.4919

December 11, 2002

Mr. Ronald J. Peters, Sr.
Chief Financial Officer
Delaware Solid Waste Authority
1128 South Bradford Street
Dover, DE 19903-0455

Dear Mr. Peters:

This letter serves to confirm that Moody's Investors Service currently maintains an A2 underlying rating and an Aaa rating based on financial guarantee of MBIA on the \$31, 990,000 Delaware Solid Waste Authority Revenue Bonds.

Should you have any questions regarding the above, please do not hesitate to contact me, or the analyst assigned to this transaction, Aaron Freedman, at (212) 553-4426.

Sincerely,

Renée Boicourt for RAB

Renée Boicourt

RAB: AF: ev
cc:

Research:

Return to Regular Format

Summary: Delaware Solid Waste Auth; Revenue - Utility, Solid Waste/Resource Recovery

Publication date: 18-Jul-2000

Credit Analyst: Paula Costa, New York (1) 212-438-7983; Edward R McGlade, New York (1) 212-438-2061

Credit Profile

AFFIRMED

\$37.800 mil. Delaware Solid Waste Auth Solid Waste Sys A

OUTLOOK:

STABLE

Rationale

The rating on Delaware Solid Waste Authority's (DSWA) utility revenue and solid waste system revenue bonds and its above-average business profile score of '3.6' reflect:

- A good economic flow control mechanism,
- Stable waste flow tonnage,
- Strong reserves,
- Competitive tip fees.

These strengths are tempered by the potential for cash flow to be affected by rebate payments.

The bonds are secured by net revenues of authority operations and other available reserves, including the bond redemption and improvement fund. In addition, the legislation that created DSWA authorizes it to assess a fee on all property in the state. DSWA has not used such power, preferring to rely on its waste disposal operations to provide revenues to pay operating and bond expenses.

DSWA provides statewide solid waste disposal in three landfills that are efficient, clean, and use the latest technologies. The system has a minimum of 15 years of landfill capacity remaining. Waste flow tonnages remained stable at about 800,000 tons from 1993-1999. Currently, 90% of tonnage is delivered by private haulers to DSWA under 192 contracts. DSWA offers 36-month contracts under the Differential Disposal Fee program, which features a rebate of \$10 off the nominal \$58.50 tip fee and an additional rebate if annual tonnage exceeds 800,000 tons per year. Indicative of competitive rates, 40 of the 47 solid waste collectors have taken advantage of the program. The tip fee has been unchanged over the past six years; it is not expected to increase through 2002.

Financial performance has been historically healthy, evidenced by debt service coverage of 1.2 times (x)-1.3x in 1996-1998. Although unrestricted liquidity was also healthy at fiscal year-end 1999, with about 130 days' unrestricted cash, rebate payments, which are paid after debt service, can potentially affect cash flows. There will be capacity for additional debt as annual debt service levels decline by half from current levels after 2003. The primary capital improvement in the horizon is expansion of landfill capacity at the Cherry Island facility. Construction is expected to begin in fiscal 2003, with costs, estimated between \$50 million-\$60 million, to be funded by additional debt.

Outlook

The stable outlook reflects the system's good economic flow control provisions, competitive tip fees, and healthy reserves.



& Associates Ltd

A member of The Elko Advisory Group LLC

Albert L. Elko
Michael J. Reinking
Joseph J. Glowacki
Robert G. Morlock
Marc R. Simmons
Michael Pozielli
Gregory D. Stratoti
Leonard V. Santivasi
John J. Mihill
Richard J. Thomas

CERTIFIED PUBLIC ACCOUNTANTS

**CERTIFICATION OF COMPLIANCE
WITH FINANCIAL ASSURANCE MECHANISM
FOR CLOSURE AND POST CLOSURE CARE COSTS**

I, Richard J. Thomas, CPA, CVA, Shareholder of Elko & Associates Ltd, Certified Public Accountants engaged as independent auditors of the Delaware Solid Waste Authority, do hereby certify that the information in the Authority's Chief Financial Officer's letter of **Certification of Compliance with Financial Assurance Mechanism for Closure and Post Closure Care Costs** is consistent with the Authority's audited financial statements for the year ended June 30, 2003.

WITNESS: Marc R. Simmons SIGNED: [Signature]
DATE: 12/9/03

ATTACHMENT XI-B
FAA Letters



DELAWARE SOLID WASTE AUTHORITY

N.C. Vasuki, P.E., DEE
Chief Executive Officer

Pasquale S. Canzano, P.E., DEE
Chief Operating Officer

May 10, 2001

Board of Directors

Richard V. Pryor
Chairman
Ronald G. McCabe
Vice Chairman
J. Donald Isaacs
Theodore W. Ryan
Phyllis M. McKinley
John P. Healy
William J. DiMondi

Mr. Bill Merritt
Eastern Regional Office
Air Traffic Division, AEA-530
JFK International Airport
Fitzgerald Federal Building
Jamaica, NY 11430

Dear Mr. Merritt:

Re: Determination of No Hazard to Air Navigation
Aeronautic Study No. 99-AEA-2721-OE


This letter follows up on e-mails sent on March 29, 2001 and May 1, 2001.

Per our telephone conversations regarding the determination of no hazard to air navigation, Aeronautical Study No: 99-AEA-2721-OE (Prior Study No: 95-AEA-0754-OE), you believe that no further action is required on our part and that the landfill will be labeled on FAA plans as fully constructed to elevation 311' which includes warning lights for airplanes..

This determination was set to expire on April 23, 2001. It was made for the extension of the height of our landfill. As we discussed, it will be many years before the height of the landfill will reach the elevation described in the determination.

Should you have any questions please feel free to call.

Very truly yours,


Anne Germain, P.E.
Manager of Engineering

sld/g:merrittltr

Federal Aviation Administration
EASTERN REGION, AEA-520
BLDG 111, JFK INTL AIRPORT
JAMAICA, NEW YORK 11430

AERONAUTICAL STUDY
No: 99-AEA-2721-OE
PRIOR STUDY
No: 95-AEA-0754-OE

OCT 2 1999

ISSUED DATE: 10/23/99

RODNEY F. ALEXANDER
DELAWARE SOLID WASTE AUTHORITY
P.O. BOX 455
DOVER, DE 19903

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has completed an aeronautical study under the provisions of 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerning:

Description: LANDFILL

Location: WILMINGTON DE
Latitude: 39-43-30.00 NAD 83
Longitude: 075-30-50.00
Heights: 263 feet above ground level (AGL)
311 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

-As a condition to this determination, the structure should be marked and/or lighted in accordance with FAA Advisory Circular 70/7460-1J, Obstruction Marking and Lighting, Chapters 3 (Marked), 4, 5 (Red), & 13.

-It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

☒ At least 10 days prior to start of construction
(7460-2, Part I)

☒ Within 5 days after construction reaches its greatest height
(7460-2, Part II)

This determination expires on 04/23/01 unless:

- (a) extended, revised or terminated by the issuing office or
- (b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case the determination expires on the date prescribed by the FCC for completion of construction or on the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

-As a result of this structure being critical to flight safety, it is

required that the FAA be kept apprised as to the status of this project. Failure to respond to periodic FAA inquiries could invalidate this determination.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, frequency(ies) or use of greater power will void this determination. Any future construction or alteration, including increase in heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at 718-553-2560. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 99-AEA-2721-OE.


William E. Merritt
Specialist, AIRSPACE BRANCH

(DNE)

7460-2 Attached

SUPPLEMENTAL NOTICE

Submission Instructions: For Advance Notice of Actual Construction or Alteration. Complete items 1, 2, 3A(1), 3A(2), and 5. If applicable, also complete items 4 and 5. Detach Part 1. Fold and tape at bottom. Mail to the FAA Regional Office for your area. Part 1A is provided for your file.

Aeronautical Study No.

99-AEA-2721-OE



U.S. Department of Transportation
Federal Aviation Administration

Notice of Actual Construction or Alteration

(Please Type or Print on this Form)

1. Construction

A. Type and Description of Construction

- ☐ New
☐ Alteration

B. Owner of Structure

2. Construction Location --- Height

A. Coordinates (To hundredths of seconds, if known)

Latitude

Longitude

0

0

B. Location (City, State, include street Address if any)

WILMINGTON, DE

C. Construction Heights

Total Height
(Structure & Site)
Above Mean Sea Level

Site Elevation Ft. AMSL
Structure Height Ft. AGL

Ft. AMSL

D. Site Elevation Determined By

- ☐ Actual Survey
☐ USGS 7.5' Quad Chart
☐ Other (Specify)

E. Reference datum of coordinates

- ☐ NAD 27
☐ NAD 83
☐ Other (Specify)

**F. Name of Nearest Public-Use or Military Airport
(Include Distance and Direction from the Airport)**

3. Construction Notifications

A. Notification

(Notice is Critical to Flight
Safety --- FAR Part 77 Required) ★

Date

B. Construction/Project

Date

- ★ (1) Construction will start
(Submit at least 48 hrs. in advance)

(1) Project Abandoned

(2) Estimated Completion

(2) Construction Dismantled

- ★ (3) Structure Reached Greatest Height
(Submit within 5 days)

4. Marking and Lighting

A. Marked

☐ Yes ☐ No ☐ Temporary

B. Lighted

☐ Medium Intensity White
☐ Dual (Medium Intensity
White & Red)

☐ High Intensity White
☐ Dual (High Intensity
White & Red)

☐ Red
☐ None

5. Antenna Requiring FCC License

A. Call Sign**B. Frequency****C. Date Applied for FCC Construction Permit****D. Date Construction Permit Issued**

6. Preparer's Certification

A. Proponent's Representative

Name:

Address:

Tel. No.: (Include Area Code)

A. Construction Proponent

Name:

Address:

Tel. No.: (Include Area Code)

I hereby certify that the information provided is true, complete, and correct to the best of my knowledge.

Signature

Title

Date

Notice is required by 14 Code of Federal Regulations, part 77 pursuant to 49 U.S.C., Section 44718. Persons who knowingly and willingly violate the notice requirements of part 77 are subject to a civil penalty of \$1,000 per day until the notice is received, pursuant to 49 U.S.C., Section 46301 (a).

Airspace Branch

Carl Zimmermann, Branch Manager (x-2616)
 Robert P. Alexander, O/E Specialist NY, NJ, WV (x-4546)
 Bill Merritt, O/E-Airspace Specialist, DC, DE, MD, (x-2560)
 PA
 Frank Jordan, O/E-Airspace Specialist, VA (x-4521)
 Lisa Patterson, Airspace Tech, VA, DC, DE, MD(x-2610)
 Angelique Lestrad, Airspace Tech, NJ, PA (x-2611)
 Kathleen Cunningham, Airspace Tech, NY, WV (x-2614)
 Stu Cohen, Environmental Specialist (x-4522)



Dial 718-553+extension for person listed.

Federal Aviation Administration Eastern Region Air Traffic Division

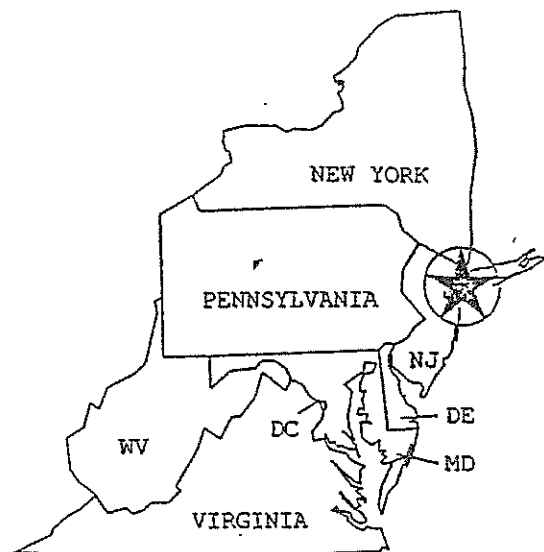
Airspace Branch, AEA-520

Fitzgerald Federal Building # 111
 J.F. Kennedy Int'l Airport
 Jamaica, NY 11430

AIRSPACE BRANCH WEBSITE

[HTTP://WWW.FAA.GOV/REGION/AEA/ATSOEAAA/FRAMEDOC.HTM](http://www.faa.gov/region/aea/atsoeaaa/framedoc.htm)

E-Mail Bill.Merritt@faa.gov



8260.19C
 Appendix 2

9/16/93

APPENDIX 2. OBSTACLE ACCURACY STANDARDS, CODES AND SOURCES

<u>HORIZONTAL</u>			<u>VERTICAL</u>		
Code	Tolerance		Code	Tolerance	
1	+20'	(6 m)	A	+3'	(1 m)
2	+50'	(15 m)	B	+10'	(3 m)
3	+100'	(30 m)	C	+20'	(6 m)
4	+250'	(75 m)	D	+50'	(15 m)
5	+500'	(150 m)	E	+125' (every 100')	(38 m)
6	+1000'	(300 m)	F	+250'	(75 m)
7	+1/2 NM	(900 m)	G	+500'	(150 m)
8	+1 NM	(1800 m)	H	+1000'	(300 m)
9	Unknown		I	Unknown	